ACTIVITY 8

DESIGNING A CLEAN-AIR ENVIRONMENT

This activity gives students an opportunity to explore how air pollution in a city can be minimized by the arrangement of living areas, working areas, and landscaping. It is related to the warm-up called "Making Decisions" and the activities "How Green Are We?," "Deciding to Clean the Air," and "Lifestyles and the Environment."

CRITICAL OBJECTIVES
☼ Recognize that the arrangement of living areas, workplaces, and landscaping affects air pollution levels
☼ Realize that necessary choices are not always clear cut
☼ Understand that automobile exhaust and the power production required to run air conditioning units contribute to air pollution

SKILLS
☼ Making decisions
☼ Hypothesizing

GUEST PRESENTERS
Guest presenters for this activity could include architects, EPA environmental protection specialists, or urban planners

BACKGROUND
By giving some thought to the location of different required elements of a city, we can reduce the use of polluting fuels and use environmental processes to aid us in our goals. If the places we go to often are near one another, we drive less and pollute the air less.

The nitrogen oxides (NOx) and carbon dioxide (CO_2) in automobile exhaust contribute to the greenhouse effect. The global temperature rise that is a predicted result of the greenhouse effect could cause major shifts in global weather patterns and a rise in sea-levels. These same components of automobile exhaust are also the ingredients that react with sunlight to form "smog."

By planting trees near highways, CO_2 in automobile exhaust will be absorbed by the leaves and turned into oxygen through photosynthesis. By planting trees and shrubs to shade the roofs, windows, and air conditioning units of our homes in the summer, we don't need to run the air conditioner as much. This, in turn, reduces air pollution because it reduces electricity generation at power plants. Power plants

REFER TO READING MATERIALS
"Air Pollution"
"Smog"
"Automobiles and Air Pollution"

TARGET GRADE LEVEL
4th - 9th

DURATION
30 minutes in first class; 40 minutes in second class with guest presenter

VOCABULARY
Carbon cycle
Electricity
Energy
Greenhouse effect
Planning
Smog

MATERIALS
Chalk
Chalkboard
Pencils

WORKSHEETS INCLUDED
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that run on fossil fuels typically emit many pollutants, including sulphur dioxide, carbon monoxide, nitrogen oxides, and suspended particulates. Perhaps more importantly, burning fossil fuels or wood produces large amounts of carbon dioxide, which contributes to the greenhouse effect.

While designing a city with these considerations in mind, students will see that their choices have important consequences and that not all problems have satisfactory solutions. This is related to real tradeoffs such as short-term gain versus long-term benefit and convenience versus conservation.

WHAT TO DO

1. Explain that the students are going to do two related activities. They will work alone on the first project. Hand out a copy of the attached worksheet to each student and ask them to cut out and arrange the elements from the worksheet on another piece of paper to layout a "city" that looks like the one they live in. For this exercise, define the boundaries of the city: the neighborhood near the school, each student's home neighborhood, or the whole city. You may want to get them started by identifying the relative location of a few important landmarks or highways. You can decide which of the elements on the worksheet the students are to use.

2. While the students are working, lead a discussion about how much time families must spend driving around in their cars because of the distances between places. Does the layout of the city contribute to air pollution by separating, for example, working and living areas? Students can analyze their city layouts as the discussion progresses. Have them save their layouts for the second part of the exercise on another day.

3. For the second exercise, you or the guest presenter will need to review with students the concepts of the carbon cycle, the greenhouse effect, smog, and how the production and use of energy (heating, electricity, cooling) causes air pollution. This second exercise will be done in small groups. Form the groups and hand out a clean worksheet to each group. Explain that the students are going to pretend to be urban planners. Urban planners are professionals who determine the arrangement of roads, buildings, and parks in a city. Students are to design a city from the ground up. **When deciding on the placement of the necessary elements and choosing energy sources, their primary goal will be to minimize air pollution.**

3. After the students have designed their "perfect" cities, lead a discussion with the goal of coming to consensus on the best location for each element. Layout the elements on the students' worksheets. Erase and reposition the elements as students debate the best arrangement of elements.

4. Compare the drawings of the actual cities from the first class to the "perfect" cites designed in the second. Have the class discuss the following questions:

- How are the two cities different?

- What are some reasons you would want the workplaces—factory, office building—near homes? Far from homes? (They are more convenient if they are nearby. The farther away, the more pollution caused by cars.)

- Does the city have a public transportation system? Why or why not? Do people use them? Why or why not?

- What are the advantages of urban areas and their high population density? Disadvantages? (Fewer trees per person need to be cut down in order to build apartments as compared to suburban single family homes. Smog is more apparent in downtown areas.)

- What are advantages of suburban areas and their lower population density? Disadvantages? (Residents have to use cars more often for everyday activities, but residents get to have yards, trees, landscaping, gardens.)

- Is there a limit to the size a city can be for it to be efficient?

- How can the placement of trees help lower the use of utilities? (For example, by shading buildings to lower the use of air conditioning and as windbreaks to lower use of heating.)

SUGGESTED EXTENSIONS (OPTIONAL)

☼ Students may enjoy trying this activity using commercially available computer programs like *Sim City*™. While the program allows the user to design a city, numerous built-in modules reflect the effects of the user's decisions. For example, if the user builds a freeway, air pollution levels rise and are displayed in a pop-up graph. If the user builds ten new office buildings, smoke starts belching from the stacks at the power plant.

SUGGESTED MODIFICATIONS

☼ For higher grades, expand the project to be a multi-session activity, exploring in more depth each of the pollutant sources and reduction measures discussed in the activity. A different guest presenter could be invited to discuss each topic.

☼ For grades 8 and 9, have students collect data to support the decisions they made during the discussions in the second exercise. For example, they may locate actual figures on energy savings from not running the air conditioner, data on air pollution from cars, and case studies that

show how the use of public transportation reduces pollution or ways factories can cut emissions. Have them make presentations on their findings.

SUGGESTED READING

Bruning, Nancy. *Cities Against Nature*. Chicago, IL: Children's Press (1992).

Shaffer, Carolyn. *City Safaris: A Sierra Club Explorer's Guide to Urban Adventures for Grownups and Kids*. San Francisco, CA: Sierra Club Books (1987).

DESIGNING A CLEAN AIR ENVIRONMENT

single-family
homes

office buildings

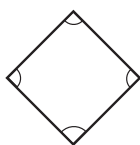walking &
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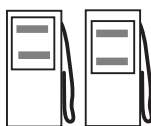
apartments &
townhouses

trees, parks, forests

bike trails

playgrounds &
ballfields

schools

gas stations

EATS

restaurants

highways

DRESS BARN   PEOPLES   AUTO PARTS

stores &
shopping malls

bus & subway
routes